SCIENCE NEWS-LETTER

The Weekly Summary of Current Science

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A MODERN CASTLE IN THE AIR

The Woolworth Tower Enshrouded in Mist

(*See page* 236)

Vol. XIV No. 393

The Continent Without a Flag

Geography

By Edwin E. Slosson

Commander Byrd in his article on "Polar Exploration by Airplane" in the papers on "Problems of Polar Research" published by the American Geographical Society states:

"It would seem inadvisable to make long flights in the Antarctic, it being more practicable, if possible of accomplishment, to advance by bases—say, one base every 200 miles. That would decrease the hazard. In view of the absence of life in the interior of the Antarctic Continent, it would be impossible to live off the country, and, in case of a forced landing 500 miles or more from the base, it probably would be likewise impossible for two or three men to pull on a sledge enough food and other equipment necessary to get back safely."

So far there have been no violent territorial disputes over the last unsettled continent, Antarctica. No wars have been fought over it, or on it, although there may be in the future. The boundaries of national claims are undefined because moving ice-sheets carry away cairns and the blizzards blow down flagpoles as rapidly as they can be raised. The British claim the lion's share of the continent in the two quadrants which they designate the Ross Dependency and the Falkland Island Dependency. The French government in 1924 officially claimed a larger sector lying south of Australia, known as Adelie Land, on the ground of its having been discovered by D'Urville in 1840, but the French claim has not been conceded by England or at least not by Australia.

If we wanted to enter this South Sea land-grabbing game we could claim a larger region, overlapping the French claim, known as Wilkes Land because Lieutenant Wilkes, later an Admiral of the American Navy, outlined the continental margin for 1800 miles, between 95 and 160 degrees east longitude. But our government has officially disclaimed any intention of asserting sovereignty over Wilkes Land, for Secretary of State Hughes stated in 1924:

"It is the opinion of the Department that the discovery of lands unknown to civilization, even when coupled with a formal taking of possession, does not support a valid claim of sovereignty unless the discovery is followed by an actual settlement of the discovered country. In the absence of an act of Congress assertative in a domestic sense of dominion over Wilkes Land this Department would be reluctant to declare that the United States possessed a right of sovereignty over that territory."

Science News-Letter, October 20, 1928

A Modern Air Castle

Aviation

The arrival of the *Graf Zeppelin*, first of the argosy of trans-Atlantic air liners that will dot the skies of the future, has shown one advantage of this means of travel—namely, speed. But the beauties of an aerial voyage are something new—something of which previous ages have never dreamed.

When a steamer arrives in New York harbor in the fog there is not much of interest for the passengers to see. When the air voyager arrives, however, he may be greeted by some such sight as that on our cover—where the tip of the Gothic tower of the Woolworth Building, highest in the world, projects upwards through the mist. As other buildings of the future equal, or even surpass this in height, the traveller will gaze on a veritable fairyland, a city of castles in the air. And then, such new devices of radio and neon light as are forecast in the article on the opposite page will permit a safe landing regardless of fog or mist. Another milestone in human progress will then have been left behind.

Science News-Letter, October 20, 1928

The British battleship Courageous has been turned into an airplane carrier, after $10,000,000 worth of remodeling.

A method of making artificial pearls by lining glass balls with irridescent fish scales was invented by a Frenchman about 1680.

In This Issue—

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All of the resources of Science Service, with its staff of scientific writers and correspondents in centers of research throughout the world, are utilized in the editing of this magazine.

Airplanes and Radio Conquer Fog

Aviation

By James Stokley

Fog on the airlines today! Idling mechanics, impatient pilots straining eyes skyward for hopeful weather signs, passengers with plans disarranged traveling by slower trains and busses, air transport at a standstill in deference to the grey blanket of meteorology.

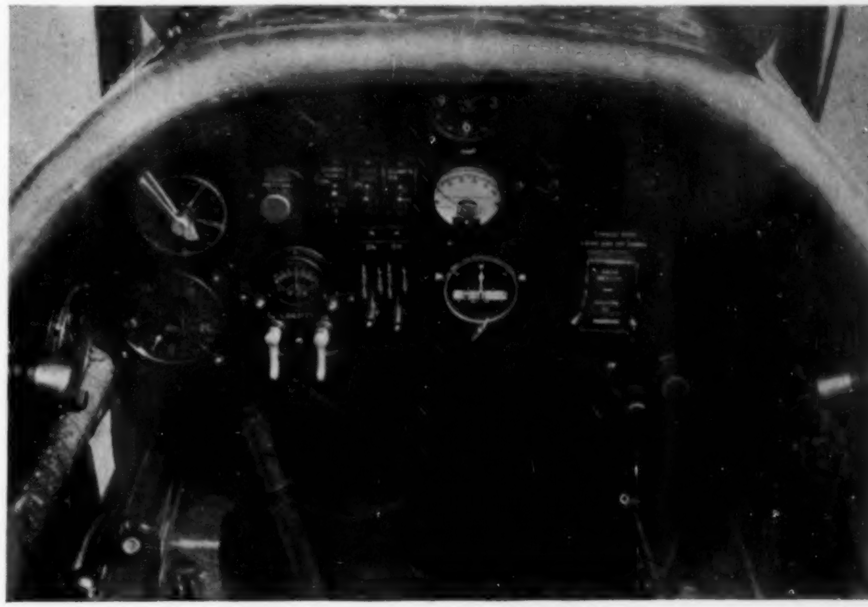
When grey mist now grips the earth, air travel must stop. But the radio is answering the airplane's SOS in remedying this condition.

Invisible beams of radio signals can now be laid through the blinding fog. Upon them the airplane can ride with assurance that it is ploughing a true air course to its destination.

The improved radio beacon for airplanes so recently perfected by the experts of the U. S. Bureau of Standards that it is not yet in practical use is an important step toward the days when airplanes will take off in the densest fog, rise to the proper flying height, make a straight airplane line to the route's terminal and land accurately and safely. Instruments will substitute for the pilot's vision rendered useless by the fog.

The latest of these mechanical sense organs is a small rectangular hole, crossed by a thin, horizontal white line broken in the middle. It is the new addition to the maze of instruments which confront the pilot as he sits in the cockpit. The plane takes off, the radio set is started, the lines broaden in a vertical direction to form white rectangles. The pilot watches them occasionally. Finally, one of the rectangles becomes a little higher than the other, the right one perhaps. Immediately the pilot turns his plane to the left, and the rectangles are again the same size. So simple as that is the operation of the latest type of radio beacon.

The radio beacon enabled the first trans-Pacific fliers to reach Hawaii. But they did not have anything so easy to operate. One man had to keep his ears to the headphones of the radio set. While the plane was on the proper course, he heard a continual hum. When he deviated from the course, the hum changed to a succession of louder and fainter buzzes, and the plane was manipulated until the sound was again continuous. As might be expected, this system required a good bit of skill on the part of the operator.



THE INSTRUMENT BOARD of the Bureau of Standards' experimental plane, showing the reed indicator installed below and to the right

To remedy this difficulty, the government scientists have tried various devices. One was a system of relays operating three lights. A white light appeared while the plane was on the proper course. Deviation to one side caused a red light to shine, to the other, a green light. The trouble with this was that it was too complicated and gave no clue as to how far the plane might be from the proper course. Then there was tried an arrangement of two neon lights. These both shone with a pink glow when on the proper course. Deviation to one side caused one of the lamps to go out. But this also gave no indication of the amount of deviation, because the lamps either glowed brightly, or didn't glow at all.

Another device used was an ammeter, in which the pointer was at the center of a dial when on the correct route, swinging to one side or the other depending on which way the deviation occurred. But this had the serious disadvantage that when anything happened to stop the radio completely, the pointer remained right in the center. The pilot might have no idea that anything had happened, and might think he was still going the right way.

The so-called "reed indicator," which has just been developed, and which was described in the opening part of this article, seems to be the ideal, and is likely to be adopted. Already it has been installed experimentally on two planes, and soon will be in use on a number of others, flying over commercial routes. So far it seems remarkably successful.

All of the radio beacons that have been tried have used the same principle, and the transmitting equipment has remained substantially the same. It is the same fundamentally as the radio compass that enables ships entering New York, or other harbors, to get their position precisely even in a fog. The ship's radio compass takes advantage of the fact that a loop antenna, a coil of wire that takes the place of the more familiar aerial, gives the loudest signals when the direction of the coil is pointed at the radio transmitting station. When the plane of the coil is at right angles to the direction the received signal almost completely disappears.

A loop can also be used for transmitting. Then also the greatest intensity is in the direction of the coil. The radio beacon uses a transmitter with two such coils at right angles. Both use the same wave length but one sends out a note a little higher than the other. If a receiving station, whether on the ground or in an airplane, is on line with one of the transmitting loops, it picks up one note well and the *(Turn to next page)*

Airplanes and Radio Conquering Fog—*Continued*

other not at all. On line with the other loop, the other note is picked up well, to the exclusion of the first. If the station is on a line halfway between the two aerials, the two notes are received, and with equal strength.

With the first form of radio beacon, the method was to send out alternate signals from each aerial. The airplane that was flying along the proper route heard first one and then the other with his radio set. When he departed from it one was louder than the other. The latest method, however, consists in sending a signal continuously from both aerials. Two separate wave lengths might be used but that would be more complicated, and would require two sets on the plane. So only one wave length is employed. Over one antenna is sent a note of 85 cycles, which means that it vibrates 85 times a second, while the other one sends out a 65 cycle note.

The radio set on the plane picks up both notes, they are mixed together like two stations broadcasting on the same wave length. If a pair of headphones were plugged in the set, both notes would be heard. But instead of headphones, two vibrating reeds are used. These are thin strips of steel, fastened at one end. If you pluck one, it would emit a twang like a jew's harp. One reed, when thus plucked, vibrates at 85 cycles, the other at 65 cycles. Beneath them are electro-magnets connected to the radio set. When the magnets are energized 85 times a second, the 85 cycle reed vibrates, but the 65 cycle one stays quiet because it is not tuned to that frequency. It has its chance to vibrate when a signal of the lower frequency is received. As it would be hard to detect the twang of the reeds above the roar of the engine, the reeds are mounted on the instrument board so that the pilot sees their free ends, painted white, side by side and against a dark background. When they start to vibrate, the thin line spreads out vertically.

As long as the airplane is the same distance from the direction of each of the two aerials, both notes come in with equal force—the ends of the two reeds vibrate the same extent. But suppose the plane drifts towards one side, perhaps the left. Then the signal from the aerial on that side comes in more strongly, and the left hand reed vibrates more, while the right hand one vibrates less. This appears to the pilot as a lengthening of the left hand line and he knows he is off his course in that direction.

DR. J. H. DELLINGER, head of the Bureau of Standards' radio laboratory, where the radio aircraft beacon has been developed

Most of the tests of this radio beacon so far have been made with an experimental station of the Bureau of Standards at College Park, Md., but if it proves as successful in further tests as it has already, such beacons will probably be a common feature of our future airports. Already the solution of another problem that will arise when in commercial use has been solved. That is in the case of an airport where planes approach from a number of directions. Would it be necessary to have a separate set of aerials for each route? Or could the one pair of aerials be made to turn? Either of these methods could be used, but they would be troublesome and expensive. The Bureau of Standards scientists have developed a simpler scheme—using a device called a goniometer. This is a coupling arrangement between the antennas and the transmitter. Turning a coil of wire within it has the same effect as if the whole antenna system were turned. Thus, in an airport crossed in many directions, a definite schedule might be worked out, by which the pilot would know just when his signals are being transmitted.

Another improvement in aircraft radio that has been worked out in this research is the antenna carried by the plane. Until recently, the usual type of airplane antenna has been a long wire trailing below. It is kept on a reel, and is unwound as soon as the ship is in the air. Before landing it has to be wound in again, or it might catch on some object on the ground. Such an antenna is quite satisfactory for general radio work, as used in European commercial planes, for example, it permits the fliers to keep in continual conversation with their destination or the port they have just left.

With radio beacons, such a form of trailing antenna has a serious objection. Hanging as it does at an angle to the ground it has a directional effect of its own. This is constantly varying, and so introduces serious inaccuracies. The Bureau of Standards scientists have developed a vertical aerial, which consists of a metal pole extending vertically from the cockpit for a height of ten feet and supported by guy wires. A great advantage of the vertical antenna is that it will indicate when the plane is directly over the beacon transmitter, for then the signal stops completely. According to Dr. J. H. Dellinger, head of the Bureau of Standards radio laboratory, the beacon can be located within a hundred feet when the plane is not over a thousand feet above. This would be a most valuable feature in time of fog, and would help prevent such a situation as that of Commander Byrd in the America, when he flew over Le Bourget in Paris in the fog, but could not find the field.

But radio is not the only means of locating a field in fog, for excellent results have been claimed with neon lights. A neon light is a relatively new thing, but it is already common on our streets in the form of the glowing pink tube that advertises all sorts of products from automobile tires to tooth paste. Practically all of the present day schemes of television make use of a similar neon lamp in the receiver, the image that the observer sees being one of glowing neon.

Neon glows almost completely in the red region of the spectrum. Many experiments have shown that the longer rays of red light pass through fog or smoke much better than the shorter waves of blue light. The neon aircraft beacons shine with a brilliant red light that can be seen through layers of fog that ordinary light cannot pene- (*Turn to page* 241)

Ultraviolet Glass Useless in Schools

Medicine—Public Health

The following stories are from the joint meetings of the American Public Health Association, the American Child Health Association and the American Social Hygiene Association, at Chicago, October 15 to 19.

Schoolrooms and offices should spend their money on outdoor sun-parlors, rather than on the new windows that allow ultraviolet light to pass through, was the advice given by Dr. Walter H. Eddy of Columbia University at the meeting of the American Public Health Association. In homes and apartments these windows would be a great mothers' helper, saving the mothers from some of the hours spent walking up and down with babies and sitting in the park watching small children while they get their daily dose of sunshine.

Dr. Eddy experimented with rats that were fed a diet that would result in rickets, unless they got enough sunlight to counteract it. These rats were placed in cages in front of the new windows at various distances and angles and for the same length of time. Only those rats directly in the path of the sunlight failed to develop rickets. Those that were more than a few feet away or next to the window but outside of the path of the sun's rays, developed the disease.

Apparently the windows do permit the ultra-violet rays to pass into the room, but they do not go far enough or in sufficient intensity to take the place of outdoor sunshine. For office workers and school children, a few minutes' walk at noon will be more beneficial than all day spent in a room with ultraviolet light transmitting windows.

Eradication of Social Diseases

The worst of the social diseases can be made to disappear practically in our lifetime by means of the methods now at our disposal, stated Dr. Thomas Parran, Assistant Surgeon General of the U. S. Public Health Service, at the meeting of the American Social Hygiene Association.

The control and eradication of this disease is a public health problem, like the control and eradication of yellow fever and smallpox. However, the nature of these social diseases requires different methods to wipe them out and the methods that we have are costly. Research is needed, and is now under way, to simplify these methods and reduce their cost.

In every community, no matter how many cases of social diseases there are at any given time, there are always only a few active spreaders. If it were possible to quarantine these, as active cases of other communicable diseases are, the social disease situation could be quickly and radically improved. As it is, the most practical method is that of "prophylaxis by treatment" which proved its effectiveness during the war.

The death rate from these social diseases has not declined in the last ten years as have the rates for other diseases as a result of public health work. Estimates based on hospital and clinic records place the number in this country under treatment for social diseases as approximately 1,000,000 people. The cost of these diseases to state and individual is enormous and must be figured from loss of wages, cost of medical treatment and shortened life span.

Diet, Not Toothbrush

Brushing your teeth after meals is not so important as eating the right food at your meals, as far as preventing tooth decay is concerned, Dr. William R. Davis, director of the Bureau of Mouth Hygiene of the Michigan Department of Health, said in discussing what to teach children about dental health.

"If we could have early attention to small defects and correct diet, I believe we could almost wipe tooth troubles off the map, even if another toothbrush was never manufactured," declared the dentist, overthrowing the favorite idea of health educators that you must brush your teeth several times daily.

The old adage, "A clean tooth never decays," has about as much or as little truth as the one about the daily apple keeping the doctor away. Only such cleanliness as the surgeon uses in performing an operation would prevent tooth decay, and it is not possible to achieve surgical cleanliness in the mouth, said Dr. Davis. Brushing the teeth is a good habit, like taking a bath and washing the face, but as a means of preventing decayed teeth it has practically no value.

Cleanliness in Dairies

Cleanliness is the exception and not the rule in dairy establishments, Milton E. Parker said. Ordinary methods of cleaning leave a film of oil and sometimes a rough deposit, known as milk-stone, on tanks, pipelines, pasteurizers and other equipment. This occurs even when the washing compound used has the power of killing germs.

However, killing germs is not enough, for if traces of milk are left on the equipment, there is a chance for more germs to breed and get into the next batch of milk. Failure to clean thoroughly is the fault of the washing compounds in general use. Mr. Parker reported the results of experiments made with several alkali compounds and recommended crystalline tri-sodium phosphate as the most satisfactory for really cleaning dairy equipment. However, this alkali should not be mixed with carbonate or bicarbonate.

Source of Undulant Fever

Milk or milk products are probably the source of undulant fever, the new disease that is becoming more and more prevalent throughout the country, according to James G. McAlpine of the Storrs Agricultural Experiment Station and Friend Lee Mickle of the Connecticut Department of Health.

Cattle of all kinds may be infected with the germ of the disease. In countries around the Mediterranean the goats carry the germs, but in this country it has been traced to cows, where it appears as infectious abortion. When human beings drink milk from such infected cows, they may get the human form of the disease, undulant fever.

However, cows are infected with two kinds of the Bacterium abortus, the germ causing the disease. Probably only one of these two is capable of producing the disease in human beings, which is the reason why not every person drinking infected cow's milk gets it.

Must Follow Rules of Science

If advertising would invoke the aid of science it must follow the rules that govern research in science, said Dr. E. V. McCollum of the Johns Hopkins University. Particularly in food advertising, the public is being misled by a wrong use of science. Dr. McCollum presented a plan for an advisory board to consider food advertising.

The board would be composed of eminent scientific men and would only act to advise pub- (*Turn to next page*)

Public Health Meeting—*Continued*

lishers on strictly scientific matters. This board would decide on questions of accuracy, authenticity, propriety and applicability of scientific statements in food advertisements.

Advertisers themselves are feeling the need of such a board, for the idea was first suggested by John Benson, president of the American Association of Advertising Agencies. Dr. McCollum believes that publishers are also feeling perplexed over the developments in advertising of food products, which have become so extravagant in their claims.

The reason for the fierce competition prompting this wave of so-called scientific advertisements of food is that we are at present eating all we possibly can without harm, says Dr. McCollum. Advertisers, in order to sell more of any kind of food, must take advantage of present scientific knowledge of our nutritional needs. However, too many of them are being led to give the public half-truths in place of scientific facts.

Girth More Important

The new tables for determining normal weights in children will pay more attention to hip line than to height, according to a report given by Dr. Raymond H. Franzen. A child's body may be likened to a cylinder, said Dr. Franzen. The short cylinder and the tall one may weigh the same, if the short one is big around and the tall one slender.

The size and weight of the bones are most important in determining the weight of the whole body. A child can be heavy without being fat and fat without being heavy, Dr. Franzen pointed out.

Dr. Franzen studied measurements of 8,000 fifth and sixth grade children in 70 cities scattered all over the country, from New Orleans to St. Paul and from Spokane to Providence. From these studies he determined the relative importance of different measurements in determining body weight. For 11 year old boys Dr. Franzen places width of hips at 30 per cent., depth of chest at 25 per cent., breadth of chest 20 per cent., height 20 per cent., and width of shoulders 5 per cent. in their influence in determining weight. The figures are somewhat different for girls, the chest dimensions being more important and height still less so.

Need Better Tests

One of the big needs in health education at present is better tests for health, Dr. James F. Rogers of the U. S. Bureau of Education told the assembly. Our present tests are all too coarse and our attempts at measuring health result in too great standardization.

Our models are discouraging to the average child and his parents. "We are sometimes too dreadfully scientific and not sufficiently human. We are not dealing with a paragon, and it is our business to make the most of the child as we have him," said Dr. Rogers.

Since there is no satisfactory way of measuring health, it is hard to tell what the results of school health work are. To overcome this difficulty Dr. Rogers advises every school to keep a control group for comparison with the group that is having instruction and other measures for promoting health. This is the system used in every well managed laboratory and Dr. Rogers thinks it should be followed in the schools to prevent health work becoming too dogmatic.

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Airplanes Conquering Fog—*Continued*

trate. Similar lights have been suggested, and actually tried, for use in harbors as guides to ships through fog. The case is different from that of the airplane, however. When the ship is a mile away from such a light, it would have to be seen through a mile of fog, a thing quite impossible even with neon. But fog usually sticks close to the surface of the earth or water, and a few hundred feet up, the air would be comparatively clear. Thus, the pilot of a plane a mile over the field may only have to look through a few hundred feet of fog, and this is quite possible. By having such a light at each corner of the landing field, the pilot can dive down into the fog and make a good landing, even though he can barely see the field until he is almost on the ground.

Another electrical device for guiding airplanes, and that has come into wide use, is the earth inductor compass, also a development of the Bureau of Standards. With the ordinary compass, the electrical connections of the engine, as well as its steel parts, attract the needle. Also the vibration and constant swinging of the plane causes other tremblings of the needle, so it is very uncertain at best. The influence of the magnetism of the engine can be greatly reduced if the compass were placed perhaps ten or twenty feet away from it—in the tail, for instance. But then the difficulty is that the pilot can't see it. There is no way of arranging the ordinary form of compass to read at a distance.

So there was developed the earth inductor compass. It depends on the same principle that make it possible to turn a dynamo with a steam engine and get electricity out of it. That is, if you spin a coil of wire inside a magnetic field, it produces a current. In the dynamo the coil is spun by the steam engine, or whatever is used for power. The magnetic field is provided by electromagnets, called the field magnets, which are energized by the dynamo's own current. Since there must be current to cause the magnetism, and also cause the current, it is necessary to send a current from a battery, or other dynamo, through the field magnets when it is started.

But the earth inductor compass makes use of a magnetic field that is always with us, the same magnetic field that pulls the compass needle toward the north. This is the magnetism of the earth itself. Though this magnetism is rather weak, compared with that of a dynamo, it is possible to spin a coil of wire in it, and to get a current from it. In the compass there are four coils. These are spun by a little windmill device that sticks up from the plane and takes advantage of the rush of air as the plane is in flight. As the coils spin, they come into contact with two brushes, that take off the current they generate.

To produce a current, the wires in the coil must cut across the lines of force of the magnetic field. A line of force is simply the direction in which a freely suspended compass needle will point. Therefore, if the brushes are east and west of the coils, there will be no current. As the coils come into contact with the brushes, they are themselves travelling north or south, and parallel to the magnetic field of the earth. Imagine that the plane is flying east, with the brushes east and west. As long as the pilot continues in the same direction there will be no current, and the needle of an ammeter on the instrument board will remain in the center and read zero. But then the plane turns a little to the north. The spinning coils now touch the brushes while they are crossing the lines of magnetic force, and there is a current. Immediately the needle swings to the north, or right, side of the plane, to inform the pilot that he is deviating to that side, so that he can immediately correct his route.

If he does not happen to be going east or west, the position of the brushes can be changed by means of a switch located just below the indicator. So all the pilot has to do is to set this to the direction in which he wants to travel, and then to fly so that the needle stays in the center. With this compass to give him his direction, with the radio beacon to tell him the course, with the radio telephone to tell him of weather and landing conditions along his route, and with the neon lights to mark the field in all kinds of weather, flying is rapidly becoming as safe as railroading.

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The Leviathan recently set a new speed record for ocean liners by going 27.8 knots an hour which is 36.4 land miles.

Nature Ramblings

By Frank Thone

Natural History

Grizzly

"The grim, taciturn bear, the anchorite monk of the desert."

So Longfellow, in "Evangeline," termed the grizzly bear. And it was a good natural history note, too. Unlike the rather neighborly, really somewhat friendly black bear, the grizzly is a shy, aloof, gruff fellow, who wants no companionship, not even that of his own truculent species. When he comes upon a find of food in the wild, whoever else may be there stands not upon the order of his going, but goes at once. Else, sledgehammer cuffs and baerserk clawings.

The grizzly is distinguished from the black-bear group not only by his much greater size and his iron-gray, sometimes silver-gray, fur, but by a noticeable difference in form. The black bear's shoulders are not appreciably higher than his hind-quarters, but the grizzly always has a pronounced hump. His body builds up to a powerful pyramid of muscle where his neck and forelimbs join on his back—a monument to the deserved dread in which he stands among the other folk of the North American wilderness.

Once numerous throughout the West, the grizzly has now been pushed nearly to extinction. Only a few hundred specimens survive, and these are mostly protected "show" bears in national parks and forests. The largest single group is probably that in Yellowstone National Park.

In spite of his morose disposition, however, the grizzly seldom troubles human beings, and there is scarcely a clear case on recent record of his having taken the aggressive unprovoked. At the Yellowstone "bear-dumps" there are always rangers on guard with high-power rifles, but to date they have never had to fire them in defense of tourist spectators. The bears are content to feed and go their unfriendly way.

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The Search for Antiquity

Anthropology

RICHARD SWANN LULL in *Ancient Man* (Doubleday, Doran):

The rarity of fossil man is due to several factors, of which the first, perhaps, is the manner of disposal of the dead, whether by interment, burning, sealing up in the habitation of the deceased, or through no manner of care whatever. Of these the first alone is likely to preserve the skeleton, burial being a prime prerequisite to fossilization, but, as man practices it, burial is not as a rule effective. Nature's burials are more apt to render the specimen impervious to decay, because of the intimate contact of the relic and the enclosing sediments; the remains become, moreover, hermetically sealed, and, as a rule, constantly either wet or dry, thus avoiding the change from one to the other condition that hastens destructive oxidation.

Another cause of rarity lies in the fact that early man was probably largely a forest dweller, and the remains of woodland creatures are always few compared with their fellows of the sea or flood-plain. Forest forms are generally devoured by prowling beasts, their bones scattered and mutilated, and the fungi of the wooded region do the rest. Animals caught by a rising flood and buried in river sediments or in the coastal deposits are far more apt to be preserved entire, and their bones or shells, often becoming impregnated with mineral salts carried in solution by percolating waters, stand an excellent chance of fossilization. Man's shrewdness, however, even in the prehistoric period, would render him less liable to drowning accidents than creatures less well endowed. If the percentage of preservation of lower animals is small, and paleontologists have estimated that we know perhaps 114 out of every 10,000 that lived, the rarity of human relics is at once appreciated. But such have been found, and the tale of their discovery is a growing one, especially, as we have seen, in the more enlightened regions of our earth.

Field research in paleontology is best carried on in a semiarid climate, in our own West whence specimens of lower forms innumerable have come to light, in North and South Africa, on the pampas of South America. It also promises great results in central Asia where the expeditions of the American Museum have made so splendid a beginning, and in Australia the search has barely begun. The search for humanity, however, will, of course, be profitless where man did not live. North America, therefore, does not contain ancient human relics, geologically speaking, nor does South America, because of the comparatively recent advent of man in our hemisphere; but Asia and Africa should be productive of evidence of amazing interest. The tropical humid belt is rather hopeless, because of the depth of soil, that is, of disintegrated sediments and their contents, and because of the mantle of vegetation which so obscures the geology. On the other hand, the more arid regions have a scantier human population. And so the story goes.

Science News-Letter, October 20, 1928

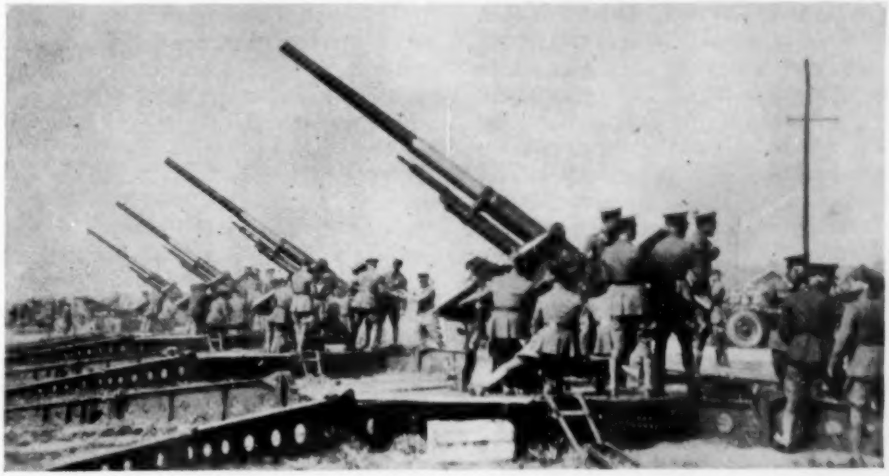
New Mobile Antiaircraft Gun Mount

Aviation—Ordnance

A new type of mount for anti-aircraft guns, which will be practically as mobile as ordinary field artillery carriages and yet as solid and stable a firing base as the concrete foundations now necessary, is being tried out at the Aberdeen Proving Grounds. Ordnance officers declare themselves very well satisfied with the new device, whose existence has only recently been made public, after more than a year of secret preliminary work.

The mount is a radical departure from the wheeled types of mount hitherto tried for anti-aircraft artillery. These shook and shifted so much under the stress of firing that they were all discarded as of no value. The new mount consists of four long steel beams that lie flat on the ground, spreading out from the gun platform at their center like the legs of an enormous insect. Each leg is jointed, and is pivoted at the point of attachment to the gun platform, so that it can be folded compactly alongside it, and the whole lifted on rubber-tired wheels to be towed by a tractor or truck.

The mount can be prepared for action from march order in about ten minutes, and restored to march order in little more than the same time. Concrete gun foundations, the only other type giving comparable stability under firing conditions, require several days for their preparation.



NEW MOBILE GUN mount, as used with a battery of anti-aircraft guns at the Aberdeen Proving Grounds, in Maryland. Note the folding spider-like legs, projecting from each corner, which stabilize the mount

The gun used on the new mount is the recently adopted standard three-inch Army antiaircraft piece, which throws a 15-pound shell to a height of 12,000 yards and an extreme horizontal range of 19,000 yards. Crack gun crews have worked up a firing speed of 30 rounds a minutes with this gun, thus enabling a battery of four pieces to attack a plane with something over a quarter of a ton of steel and TNT in the space of a minute.

A feature of the new gun is the easy removability of the liner or inner tube when it has become worn out with constant firing or otherwise damaged. The old liner can be taken out and a new one slid into place, under field conditions, in about 30 minutes. This will enable a battery to keep the field constantly, avoiding slow and costly returns to the arsenal for relining.

Science News-Letter, October 20, 1928

Americans Furnished Fuel for Zeppelin

Aviation

Three thousand cylinders of special gas fuel for the German dirigible Graf Zeppelin were provided at Lakehurst, N. J., to fuel the ship for its return voyage across the Atlantic.

Unlike the Blau gas fuel that the airship used on its voyage to America, the million cubic feet of American product is made from fractionated natural gas and is a synthetic mixture of ethane, about the density of air, methane, lighter than air, propane and butane, both heavier than air. These gases are carefully proportioned until the resulting mixture has a density of 1.05, only slightly heavier than air. Arrangements for the supply of this gas by a Louisville, Ky., concern were made by the U. S Navy as an act of courtesy to the German ship which is the guest of its sister, the dirigible Los Angeles, in its large two-berth hangar at Lakehurst.

Both the German Blau gas, so-called because it was first made by a German by that name, and the American substitute, allow the dirigible to carry fuel which adds practically no load and does not make the ship lighter when it is burned, since it is nearly the weight of air. The fuel gas is carried in extra ballonets at the bottom of the giant envelope.

Blau gas is made by the distillation or cracking of gas oil, one of the heavier constituents of the refining of petroleum. In Germany it is obtainable commercially for heating and illuminating purposes and a plant is located at Friedrichshafen, the home port and place of manufacture of the Graf Zeppelin.

The use of air-weight gas fuel eliminates the necessity of a water-recovery apparatus such as devised by American government engineers for the conservation of weight on the dirigible Los Angeles. Any fuel when burned produces water by the union of the hydrogen of the fuel and the oxygen of the air and as this water is about equal in weight to the fuel consumed, it will maintain equilibrium of the ship if it is condensed from the exhaust gases and conserved. Such water recovery has worked successfully on the dirigible Los Angeles and it will be a question for future experience to determine which system will be used on the dirigibles of the future. Not all the fuel of a trip can be carried in the form of fuel gas, however, and Graf Zeppelin relies largely on gasoline as the hundred or so Zeppelins did before her.

Science News-Letter, October 20, 1928

In law courts of medieval London a group of ruffians might be sentenced to hang, not for any specific crime, but because they were notorious thieves.

A Condor as a Pet

Ornithology

WILLIAM L. and IRENE FINLEY, in *Wild Animal Pets* (Scribner's):

The die was cast. We slipped the young condor into a gunny sack, cutting a hole for his head. Both parents watched us curiously a few feet away. What could have been in their minds? They made no movement of alarm. It was as if they understood and were willing to part with their offspring. They could have had no premonition of a tragedy yet to come.

When General, for so he was called, began his long journey from the mountain haunts in southern California to his new home, a camp on the bank of the Willamette River in Oregon, he quickly put away his cave-like tactics; fear and ferocity gave way to gentleness. It was a response to kindly treatment. By the middle of August his wings were well fledged but he still wore a vest of gray down. With wings extended he measured nine feet. Still his pinions were in the making; they could not yet support such a heavy body.

At night he stayed in a big enclosure, where he had the stump of an old tree for a perch. During the day the primordial freedom of the race made him restless, so each morning he was let out. If he was not released at the usual time, he soon attracted our attention by climbing up the wire and poking his nose through the gate. When it opened, out he stalked, but always stopped cautiously a minute or two outside to look about. He did nothing without deliberation. With several heavy hops, he went half-way across the yard, flapping his big wings. Then he went through a regular dance as if celebrating his freedom. He stretched his wings and jumped straight up in the air several times in succession; but he never said a word.

General was as playful as a pup. In the morning, after his breakfast, he was ready for a game. Down he jumped and pounced upon a stick or a leaf, shook it in his bill, dropped it just to jump upon it with both feet and toss it up again. He was extremely fond of pulling on a rope, and sat back and tugged on it like a bulldog, with lunging jerks and excited eyes. This was his hilarity after confinement: he could hardly control himself.

Down on the river-bank, just below camp, a big stump stuck in the sand. This was General's lookout, where he loved to sit, with wings spread wide to the sun and watching the life on the river. Almost daily a turkey-vulture or two sailed overhead, turning to look at him, not quite understanding why he stayed there. The crows, with a pretense of alarm, perched in the willows and alders near by, or cawed raucously down at him as they sailed off toward the tall firs. Casting a weird and gentle eye about, he sat as if in revery, watching every movement.

Two things were a nuisance in General's life. Visitors he treated with an air of shyness closely akin to suspicion; the camera was a positive bore to him. Ordinarily we petted him any place about the yard, but let a camera come into view and he edged away. Perhaps he remembered it in his early days, when he was pulled out of the nest and hissed in defiance at being set up before the one-eyed monster. He was in a savage state then and fought as best he could; now he took refuge on one of his highest perches.

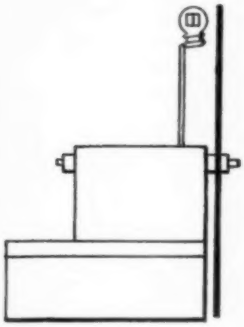
With the members of the family alone at home he came and went about the yard as if he were one of them. When his friend and companion took an axe and went across the creek to split wood, General tagged at his heels. . . .

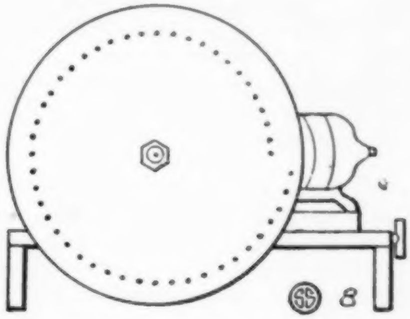
Contrary to expectations, General was cleanly in his habits. He had been fed on fresh meat since he was taken from his nest, and soon he would have nothing else. Several times we tried him on stale meat, but he would have none of it. If a piece dropped on the ground, or was the least bit dirty, he refused it. Neither would he touch wild game, such as squirrel and rabbit, if he could get fresh beef. Running water was a luxury. He pattered along in the creek for an hour at a time, and played about the hydraulic ram. When he decided to bathe he jumped under the spouting water and wallowed in the pool. He was soon soaked through and stepped out for a moment; but, not feeling thoroughly washed, in he went again. He kept this up until he could hardly walk, then climbed a perch and hung out his wings to dry by stretching them wide in the sun.

Science News-Letter, October 20, 1928

Making Your Own Radiovisor

Radiovision





This is the sixth of a series of articles especially prepared for Science Service by one of the first of radiovision inventors. In future articles Mr. Jenkins will describe other kinds of radiovisors.

By C. Francis Jenkins

The radiovisor is now complete. To work with it, you will need a radio set just as you need a receiver to feed the detected and amplified impulses into your loud speaker.

For satisfactory results you will probably have to have a receiving set with a resistance-coupled amplifier. Ordinary radio sets, built with transformers in the audio stages of amplification, will distort the image of the radiomovies too much. You can, however, experiment with the set you have. If you do, remember this warning and do not get discouraged.

Most radiovision broadcasting is now on short wave lengths and ordinary commercial receivers, even if they had resistance coupling which very few do, would probably not be able to reach these ranges.

You will therefore probably desire to build your own receiver and the accompanying circuit diagram of proven worth will guide you.

Standard parts, easily obtainable, are used as follows:

C1—2 pieces $1\frac{1}{2}$-inch square copper plates spaced $\frac{1}{4}$-inch.
C2—.01 M. F. D. Mica coupling condensers
C3—At least 1 M. F. D.
C4—At least 4 M. F. D.
C5—.00025 M. F. D.
C6—.00014 M. F. D. Variable condensers
C7—.001 M. F. D.
SW—Speaker and Neon Lamp cut-out switch
All resistors must be non-inductive
R—2 to 7 megohms
R1—.025 megohms
Rp—.25 megohms
Rg—1 megohm
Rg1—.5 megohms
L1—5 turns 3-inch dia. No. 18 D. C. C. Wire
L2—6 turns 3-inch dia. No. 18 D. C. C. Wire
L1 and L2—Spaced $\frac{1}{4}$-inch
Antenna—50 to 100 feet total length

Now that the radiovisor is assembled and ready for use, you can tune in for radiomovies. (*Turn to next page*)

Films of Gold Show Electronic Waves

Physics

A thin film of pure gold, far thinner than the thinnest gold leaf, affords new evidence that electrons are waves, or at least, accompanied by waves. Electrons, the building blocks of which atoms are supposed to be made, were formerly thought of as being like small particles, but modern physicists think that they more nearly resemble waves like light or even radio waves; though much shorter in length, or higher in pitch.

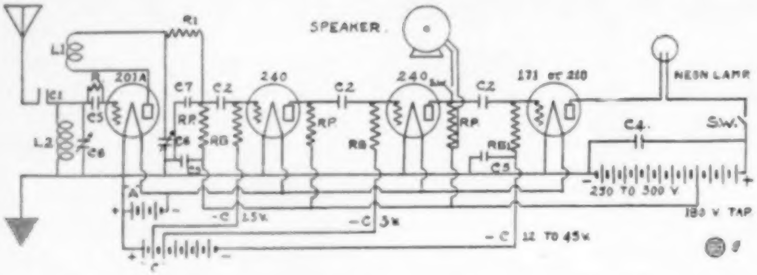
Prof. George P. Thomson, of the University of Aberdeen, and son of Sir J. J. Thomson, one of the most eminent of present-day English physicists, has made the gold-film experiments, which he recently reported to the Royal Institution. A thin film of metal, such as he used, is a screen of molecules that permits the physicist to tell waves from particles. The arrangement of the gold molecules forms a lattice. If a stream of tiny particles is aimed at the screen, they hit molecules at a variety of angles, and so the stream emerges from the other side spread out as a cone. But waves are affected differently. When they go through such a screen they prefer to bend at certain angles. Therefore, if a photographic plate, which is darkened by the electrons, is placed a short distance back of the gold film when the electrons are passed through, a black spot will appear on the plate, surrounded by a series of concentric rings. The black spot represents the bulk of the electrons, which pass through without deviation, the rings represent those which are bent at various angles.

In performing this experiment, Prof. Thomson obtained exactly this effect. Furthermore, to prove that it was not due to light, which is known to behave in a similar manner, he repeated the experiment with a magnet nearby. Electrons are pulled out of their course by a magnet, while light is not. With the magnet, the rings were displaced, as they should be if the effect was due to the electrons. So it is demonstrated rather conclusively that a stream of electrons contains waves. Whether these waves are the electrons themselves, or merely accompany the real electrons, is still a speculation. However, he has measured their wave length and has found that their pitch is more than a million times higher than that of visible light, far higher than that of X-rays, and, except for the cosmic rays, higher than that of any known radiation.

But Prof. Thomson points out that the electron waves are not like light waves. Even if they were as low in pitch as light waves, they would not be the same. They travel at different speeds, the electron waves are bent by electric and magnetic fields, while ordinary light is not, and their penetrating powers are quite different. "If they are actual motion of an ether," he says, "it must differ in some way in the two cases."

Science News-Letter, October 20, 1928

Radiovision—*Continued*



Connect your radio output to the lamp, preferably through a switch, with about 180 volts in circuit with the switch and lamp. A power pack can be used instead of "B" batteries.

The glowing electrode (cathode) of the lamp should face the lens and disc, of course. If it does not, reverse the electric connections.

Now go ahead and tune in the station broadcasting pictures (3XK at Washington, D. C., is 46.7 meters, and is broadcasting every Monday and Wednesday and Friday nights at 8 o'clock, Eastern Standard Time), then adjust the speed of the scanning disc to 900 R. P. M., which means only that you slide the motor board outward from the scanning disc center until your picture comes in, as you look through the top of the disc at the neon lamp.

Begin with motor about 2 inches from the scanning disc center, and draw it outward, very slowly or you will go past the point of synchronism. It is surprisingly easy to get synchronism by this mechanism.

At first, with an induction or D. C. motor, there will be only black and white dots and dashes in the picture area, but when the speed of the disc has been brought into synchronism with the speed of the transmitter at the broadcasting station, the picture will suddenly appear, as one looks at the lamp through the flying holes of the scanning disc.

When the transmission of the picture ends, the picture frame on your radiovisor is smooth pink, and you should switch it off and switch on your loudspeaker, so that you may listen to the announcer again.

If the picture appears upside down, take off the disc and turn it around, other side out. This will make the picture right side up.

For best picture reception, the receiver must be on the point of non-oscillation, or just below the point where oscillations begin. A receiver that will bring in good phone reception will produce good pictures, therefore, the receiver must be adjusted similarly.

The image received from 3XK should be in black. In other words, the lamp is continuously lighted until picture signals blink it out to make up the movie pictures in black silhouette on a pink ground.

The amount of light given off is regulated by the "C" bias on the last tube of the amplifier, although the bias must be high enough to permit the incoming picture signals to overcome the plate current, blocking the light given off by the neon lamp. It has been found that a "C" bias voltage between 12 and 45 volts on the last tube will be sufficient on all types of neon glow tubes.

Science News-Letter, October 20, 1928

An old Persian belief held that an agate has power to stop a storm.

Indian Morals

Ethnology

Chief Buffalo Child Long Lance, in *Long Lance* (*Cosmopolitan*):

Our moral training was entirely in the hands of our mothers. They would tell us about our Great Spirit; and they told us that when we grew older the Great Spirit would appoint some other good spirit in the spirit world to be our guide and look after us. This spirit would give us our "medicine"—lucky charm—our medicine-song and our death song; the former to be sung at all times when in trouble, the latter when we were called to die.

We had no Bible as the white boys have; so our mothers trained us to live right by telling us legends of how all of the good things started to be good. We had a legend for everything—from the care of our feet to the "great shame" befalling those who tell lies. Many long winter afternoons we would sit around our mother as she made skins into clothing, and listen to the magic stories of righteousness which she was passing on to us from the dark, unknown depths of our history. . . .

We had a legend for everything that was good, and the more we youngsters lived up to the legends which our mothers told us, the more highly respected we were in the tribe. We tried hard to remember each legend and to live out the moral that it taught us.

Science News-Letter, October 20, 1928

The Greek physician Hippocrates declared that certain mental diseases were brain disorders, but even in the nineteenth century insanity was still looked upon by many people as a mysterious malady of divine origin.

Thirty years ago, when the Weather Bureau began to issue flood forecasts far in advance for the lower Mississippi, the Bureau was accused of unduly alarming the people; but the warnings soon proved their value beyond question.

FIRST GLANCES AT NEW BOOKS

THE FERN ALLIES OF NORTH AMERICA—Willard N. Clute—*Joliet, Ill.: The Willard N. Clute Co.* ($4). There are many popular flower guides and many fern books, but the interesting and botanically important group of fern allies—horsetails, club-mosses, quillworts, and so on—have been left, in recent time at least, to a single author. Fortunately, Mr. Clute is well equipped; he knows the botany of his subjects thoroughly and at the same time has a most happy faculty of presenting his facts in interesting popular language without surrendering essential, or even technical, accuracy. This revision of *Fern Allies* gives a new generation of students a chance at a work no field botanist can well do without.

Botany
Science News-Letter, October 20, 1928

THE FERNS (FILICALES), vol. III—F. O. Bower—*Macmillan* (30 s). The third volume of a series dealing exhaustively with the classification and structure of ferns; this volume is concerned with the leptosporangiate ferns.

Botany
Science News-Letter, October 20, 1928

COMMON WILD FLOWERS OF PENNSYLVANIA—Ernest M. Gress—*Altoona, Pa.: The Times and Tribune Company* ($.75). Chattily written running descriptions of the more usually seen wild flowers of Pennsylvania, illustrated with photographs taken in their natural habitats.

Botany
Science News-Letter, October 20, 1928

PLANT LIFE AND ITS ROMANCE—F. E. Weiss—*Longmans, Green* $1.80). A series of twelve radio talks brought together in printed form by a well-known English botanist.

Botany
Science News-Letter, October 20, 1928

ABSTRACTS OF THESES—Science Series, Vol. V—*University of Chicago Press* ($3). The University of Chicago has adopted a new system. Instead of requiring the publication of Ph. D. theses in a way that scattered them among the various scientific periodicals and often delayed their printing for years, all the theses are published in abstract in a single volume. The present volume contains 76 papers in the fields of mathematics, astronomy, physics, chemistry, geology, geography, botany, zoology, anantomy, physiology, physiological chemistry, bacteriology and home economics.

General Science
Science News-Letter, October 20, 1928

BUREAU OF STANDARDS JOURNAL OF RESEARCH; Vol. 1, No. 1—*U. S. Gov't Pr't'g Off.* ($2.75 per year). This is the first issue of a new publication by the U. S. Bureau of Standards, that will supersede the "Scientific Papers" and "Technologic Papers" previously issued. It is announced that the new publication will carry the results of the Bureau's researches, both theoretical and applied, but more than that, it will contain critical reviews in the field of science and technology. The first number promises well for the future. Five papers are given, on tests of organic protective coatings, pneumatic tires, reflectometry, interferometer measurements of wave-lengths of the titanium spectrum and analysis of bauxite and other refractories.

General Science
Science News-Letter, October 20, 1928

GALATEA OR THE FUTURE OF DARWINISM—W. Russell Brain—*Dutton* ($1). "Darwin is the Newton of biology: she still awaits her Einstein," writes the author of this little book. The mechanistic philosophy arising from Neo-Darwinism falls short of being a satisfactory view of the universe, and Neo-Lamarckism is suggested as a sounder basis for interpretation of the Darwinian principles.

Evolution
Science News-Letter, October 20, 1928

BACCHUS: OR WINE TODAY AND TOMORROW—P. Morton Shand—*Dutton* ($1). This new addition to the Today and Tomorrow series combines a body of interesting information on viticulture and winemaking, with occasional caustic comments on experiments in the suppression of the wine trade; the latter, however, sometimes lapse into mere sarcasm.

Viticulture—Zymology
Science News-Letter, October 20, 1928

BOYCRAFT—*Whitman* ($.10). Here is just the book to give to the youngster who is mechanically inclined, and seeks new worlds to conquer. Despite the low price, it contains full directions for making toy boats, airplanes, bird-houses and other interesting things. Each article is fully illustrated with drawings.

Handicraft
Science News-Letter, October 20, 1928

THE RELATIONS BETWEEN THE SMITHSONIAN INSTITUTION AND THE WRIGHT BROTHERS—Charles G. Abbot—*Smithsonian Institution.* The secretary of the Smithsonian Institution herein endeavors to sift out the facts of the unfortunate controversy over the relative merits of the Langley and Wright airplanes, and to do justice to all concerned.

Aviation—History of Science
Science News-Letter, October 20, 1928

FIXATION OF ATMOSPHERIC NITROGEN—F. A. Ernst—*Van Nostrand* ($2.50). This book is both of permanent value and timely interest, written by an expert formerly of the American Cyanamid Company, then in the Nitrate Division of Army Ordnance, and now in the Fixed Nitrogen Research Laboratory of the U. S. Department of Agriculture. He gives facts and figures of the most modern methods for putting nitrogen of the air in a form so that it can be used for fertilizers, munitions, or chemical manufacturers. The question is being widely discussed at present with more heat than light in debates over the farm problem, and it would greatly clarify the atmosphere if the disputants and the public have at hand the facts in this book. For instance, the Muscle Shoals problem is still being argued about as though the fixation of nitrogen were primarily a matter of power, whereas, since the war, the situation has entirely altered. In the original arc process for nitric acid a power consumption of 61,000 kilowatt hours was required for each ton of nitrogen fixed. Now by the new direct synthetic ammonia process, with water gas hydrogen only 3,000 kilowatt hours is required per ton, a reduction of one-twentieth, so power has become a minor factor in the problem compared with cheap nitrogen.

Chemistry
Science News-Letter, October 20, 1928

WHAT'S WANTED AND ADVICE TO INVENTORS—*Institute of Patentees* (39 Victoria St., London, S. W. 1) (6d). Are you an ingenious inventor, hunting for new worlds to conquer? If so, get this book and see 339 things that the world needs, including "a device to prevent soup or other liquid from spilling out of a spoon," or "a wireless loud speaker to translate foreign languages into English."

Invention
Science News-Letter, October 20, 1928

On the Study of Popular Sayings

Ethnology

PROF. EDWARD WESTERMARCK, in the *Frazer Lecture in Social Anthropology,* before the British Association for the Advancement of Science:

It has been said to be a difficult or hopeless task to try to discover why people perform rites and ceremonies, that directly one approaches the underlying meaning of rite or custom one meets only with uncertainty and vagueness. I cannot say that this view is confirmed by my own observations in Morocco, where I generally found the natives to have quite definite ideas about their rites. But the direct inquiry into these ideas is not the only way in which they may be ascertained. The most convincing information is often obtained, not from what the natives say *about* their rites, but from what they say at the moment when they perform them. To take a few instances. That the fire-ceremonies practised in Morocco, as in Europe, on Midsummer Day or on some other particular day of the year, are purificatory in intention is obvious from the words which people utter when they leap over them or take their animals over the ashes. The Moorish methods of covenanting, which always imply some kind of bodily contact, for example, by the partaking of a common meal, derive their force from the idea that both parties thereby expose themselves to each other's conditional curses; and the idea that food eaten in common embodies such a curse is very clearly expressed in the imprecation addressed to a faithless participant. These customs, and the sayings connected with them, have led me to believe that the very similar methods—such as a sacrificial meal—used by the ancient Hebrews in their covenanting with the Deity were intended, not, as has been supposed, to establish communion, but to transfer conditional curses both to the men and their god. That one idea underlying the Moorish custom of tying rags or clothing to some object connected with a dead saint is to tie up the saint, and to keep him tied until he renders the assistance asked for, is directly proved by words said on such occasions. This has suggested to me that some similar idea may perhaps be at the root of the Latin word for religion, *religio,* if, as has been conjectured, this word is related to the verb *religare,* "to tie." It might have implied, not that man was tied by his god, but that the god was in the religious ritual tied by the man.

While a saying uttered on the occasion when a rite is performed is apt to throw light on the meaning of the rite, there are other sayings that can themselves be explained only by the circumstances in which they are used. This is the case with a large number of proverbs. It has been said that the chief ingredients which go to make a proverb are "sense, shortness, and salt," but the most essential characteristic of all is popularity, acceptance and adoption on the part of the people. Figurativeness is a frequent quality, but there are also many sayings recognized as proverbs that contain no figure of speech. On the other hand, there is hardly a proverb that does not in its form, somehow or other, differ from ordinary speech. Rhythm, rhyme, and alliteration are prominent features. . . .

Not infrequently some of the proverbs of a people contradict the teaching of others. Such incongruities may be more apparent than real. Proverbs may have the form of categorical imperatives on account of their necessary brevity, and in such cases their one-sidedness has to be corrected by others dealing with particular circumstances that modify the general rule. Moreover, as people are not all alike one maxim may appeal to one person and another different maxim to another. And there is, further, the distinction between proverbs that represent ideals and others that are based on realities which do not come up to these ideals. But it must not be assumed that a people's proverbs on a certain topic always tell us the whole truth about their feelings relating to it. The Moorish sayings concerning women and married life may serve as a warning. They are uniformly unfriendly or thoroughly prudential, and might easily make one believe that the men are utterly devoid of tender feelings towards their wives. But here we have to take into account their ideas of decency. It is considered indecent of a man to show any affection for his wife; in the eyes of the outside world he should treat her with the greatest indifference.

Proverbs are not merely reflections of life but play an active part in it; and this functional aspect of the matter should also engage the attention of the student. Proverbs teach resignation in adversity, they give counsels and warnings, they are means of influencing the emotions, will, and behavior of others, as they may influence one's own, whether they are shaped as direct commands, or as statements of some experience drawn from life, or are expressions of approval or admiration or of disapproval or contempt. The exceedingly frequent use of proverbs in Morocco, as in other countries with a Semitic culture, bears testimony to their great social adaptability. The proverb is a spice by which anybody may add piquancy to his speech, it shortens a discussion, it provides a neat argument which has the authority of custom and tradition, it is a dignified way of confessing an error or offering an apology, it makes a reproof less offensive by making it less personal. One reason for the great popularity that proverbs enjoy among the Moors is their desire to be polite; thus a proverb is often an excellent substitute for a direct refusal, which might seem inappropriate or rude. It also stops a quarrel and makes those who were cursing each other a moment before shake hands and smile. . . .

When we are sure of the intrinsic meaning of proverbs, and only then, we can find a reasonable solution of a problem that has proved a constant stumbling block to collectors and compilers, namely, their classification. If proverbs are to be treated as a source of information for the sociological or psychological study of a people they cannot, as has usually been the case, be arranged simply in alphabetical order by the first letters of the first word. They must be grouped according to the subjects or situations on which they have a bearing, and be accompanied with all explanations necessary for the right understanding of their import and implications. Proverbs that are applicable in different situations may have to be repeated under different headings; but to judge by my own experience such repetitions need not be very many.

If due attention is bestowed upon the collection of proverbs, we may hope that the scientific study of them will better than hitherto keep pace with the progress made within other branches of folk-lore.

Science News-Letter, October 20, 1928

CLASSICS OF SCIENCE: Rumford on Heat from Friction

Physics

Although the phenomenon of heat from friction is no novelty in this mechanical age, it will be interesting to measure the amount generated in a water-jacketed cylinder by various sorts of borers—cast iron, tool steel, etc.—used with and without lubricants.

AN INQUIRY CONCERNING THE SOURCE OF THE HEAT WHICH IS EXCITED BY FRICTION, presented to the Royal Society in 1798, *in The Complete Works of Count Rumford, Boston, 1870.*

Heat from Boring Cannon

Being engaged largely in superintending the boring of cannon in the workshops of the military arsenal at Munich, I was struck with the very considerable degree of heat which a brass gun acquires in a short time in being bored, and with the still more intense heat (much greater than that of boiling water, as I found by experiment) of the metallic chips separated from it by the borer.

The more I meditated on these phenomena, the more they appeared to me to be curious and interesting. A thorough investigation of them seemed even to bid fair to give a farther insight into the hidden nature of heat; and to enable us to form some reasonable conjectures respecting the existence or non-existence of an *igneous fluid*—a subject on which the opinions of philosophers have in all ages been much divided.

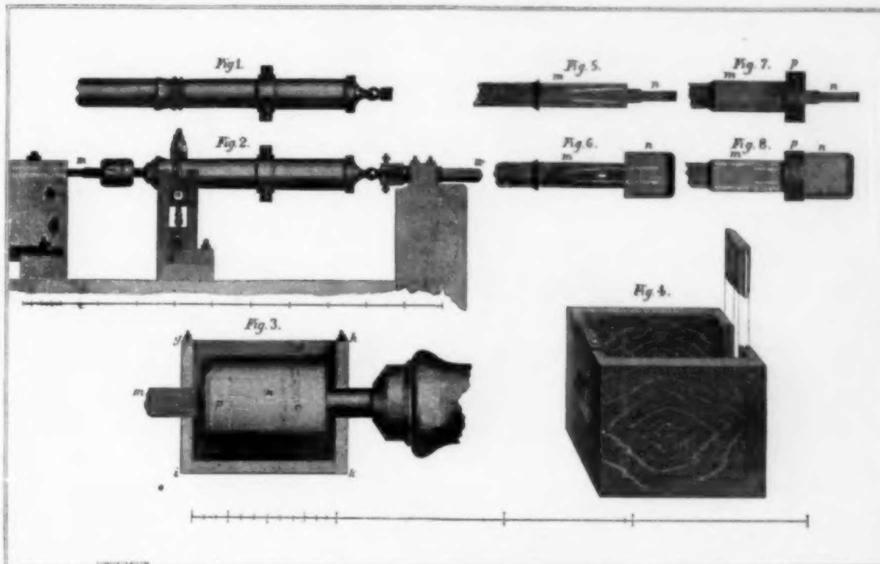
From *whence comes* the heat actually produced in the mechanical operation above mentioned?

Is it furnished by the metallic chips which are separated by the borer from the solid mass of metal?

If this were the case, then, according to the modern doctrines of latent heat, and of caloric, the *capacity for heat* of the parts of the metal, so reduced to chips, ought not only to be changed, but the change undergone by them should be sufficiently great to account for *all* the heat produced.

But no such change had taken place; for I found, upon taking actual quantities, by weight, of these chips, and of thin slips of the same block of metal separated by means of a fine saw, and putting them at the same temperature (that of boiling water) into equal quantities of cold water (that is to say, at the temperature of 59½° F.), the portion of water into which the chips were put was not, to all appearance, heated either less or more than the other portion in which the slips of metal were put.

Taking a cannon (a brass six-pounder), cast solid, and rough as it came from the foundry, and fixing it (horizontally) in the machine used for boring, and at the same time finishing the outside of the cannon by turning, I caused its extremity to be cut off, and, by turning down the metal in that part, a solid cylinder was formed, 7¾ inches in diameter, and 9 8/10 inches long, which, when finished, remained joined to the rest of the metal (that which, properly speaking, constituted the cannon) by a small cylindrical neck, only 2 1/5 inches in diameter, and 3 8/10 inches long.



COUNT RUMFORD'S EXPERIMENTAL CANNON

This short cylinder, which was supported in its horizontal position and turned round its axis by means of the neck by which it remained united to the cannon, was now bored with the horizontal borer used in boring cannon; but its bore, which was 37 inches in diameter, instead of being continued through its whole length (9.8 inches) was only 7.2 inches in length; so that a solid bottom was left to this hollow cylinder, which bottom was 2.6 inches in thickness.

This cylinder being designed for the express purpose of generating heat *by friction*, by having a blunt borer forced against its solid bottom at the same time that it should be turned round its axis by the force of horses, in order that the heat accumulated in the cylinder might from time to time be measured, a small round hole 0.37 of an inch only in diameter, and 4.2 inches in depth, for the purpose of introducing a small cylindrical mercurial thermometer, was made in it, on one side, in a direction perpendicular to the axis of the cylinder, and ending in the middle of the solid part of the metal which formed the bottom of its bore.*

Experiment No. 1

This experiment was made in order to ascertain how much heat was actually generated by friction, when a blunt steel borer being so forcibly shoved (by means of a strong screw) against the bottom of the bore of the cylinder, that the pressure against it was equal to the weight of about 10,000 pounds, avoirdupois, the cylinder was turned round on its axis (by the force of horses) at the rate of about 32 times in a minute.

At the beginning of the experiment, the temperature of the air in the shade, as also that of the cylinder, was just 60° F.

At the end of 30 minutes, when the cylinder had made 960 revolutions about its axis, the horses being stopped, a cylindrical mercurial thermometer, whose bulb was 32/100 of an inch in diameter, and 3¼ inches in length, was introduced into the hole made to receive (*Turn to next page*)

*For fear I should be suspected of prodigality in the prosecution of my philosophical researches, I think it necessary to inform the Society that the cannon I made use of in this experiment was not sacrificed to it. The short hollow cylinder which was formed at the end of it was turned cut of a cylindrical mass of metal, about 2 feet in length, projecting beyond the muzzle of the gun, called in the German language the *verlorner kopf* (the head of the cannon to be thrown away).

This original projection, which is cut off before the gun is bored, is always cast with it, in order that, by means of the pressure of its weight on the metal in the lower part of the mould during the time it is cooling, the gun may be the more compact in the neighbourhood of the muzzle, where, without this precaution, the metal would be apt to be porous, or full of honeycombs.

Rumford on Heat from Friction—*Continued*

it, in the side of the cylinder, when the mercury rose almost instantly to 130°.

Experiment No. 3

A quadrangular oblong deal box, watertight, 11½ English inches long, 9 4/10 inches wide, and 9 6/10 inches deep (measured in the clear), being provided with holes or slits in the middle of each of its ends, just large enough to receive, the one the square iron rod to the end of which the blunt steel borer was fastened, the other the small cylindrical neck which joined the hollow cylinder to the cannon . . . it is evident, from the description, that the hollow metallic cylinder would occupy the middle of the box, without touching it on either side, and that, on pouring water into the box, and filling it to the brim, the cylinder would be completely covered and surrounded on every side by that fluid. . . .

The hollow cylinder having been previously cleaned out, and the inside of its bore wiped with a clean towel till it was quite dry, the square iron bar, with the blunt steel borer fixed to the end of it, was put into its place; the mouth of the bore of the cylinder being closed at the same time by means of the circular piston, through the center of which the iron bar passed.

This being done, the box was put in its place, and the joinings of the iron rod of the neck of the cylinder with the two ends of the box having ben made watertight by means of collars of oiled leather, the box was filled with cold water (*viz.*, at the temperature of 60°), and the machine was put in motion.

The result of this beautiful experiment was very striking, and the pleasure it afforded me amply repaid me for all the trouble I had had in contriving and arranging the complicated machinery used in making it.

The cylinder, revolving at the rate of about 32 times in a minute, had been in motion but a short time, when I perceived, by putting my hand into the water and touching the outside of the cylinder, that heat was generated; and it was not long before the water which surrounded the cylinder began to be sensibly warm.

At the end of one hour I found, by plunging a thermometer into the warm water in the box (the quantity of which fluid amounted to 18.77 pounds, avoirdupois, or 2¼ wine gallons), that its temperature had been raised no less than 47 degrees; being now 107° of Fahrenheit's scale.

When 30 minutes more had elapsed, or 1 hour and 30 minutes after the machinery had been put in motion, the heat of the water in the box was 142°.

At the end of two hours, reckoning from the beginning of the experiment, the temperature of the water was found to be raised to 178°.

At 2 hours 20 minutes it was at 200°;and at 2 hours 30 minutes it *actually boiled!*

It would be difficult to describe the surprise and astonishment expressed in the countenances of the by-standers, on seeing so large a quantity of cold water heated, and actually made to boil, without any fire.

Though there was, in fact, nothing that could justly be considered as surprising in this event, yet I acknowledge fairly that it afforded me a degree of childish pleasure, which, were I ambitious of the reputation of a *grave philosopher,* I ought most certainly rather to hide than to discover.

By meditating on the results of all these experiments, we are naturally brought to that great question which has so often been the subject of speculation among philosophers; namely,

What is heat? Is there any such thing as an *igneous fluid?* Is there anything that can with propriety be called *caloric?*

We have seen that a very considerable quantity of heat may be excited in the friction of two metallic surfaces, and given off in a constant stream or flux *in all directions* without interruption or intermission, and without any signs of diminution or exhaustion.

From whence came the heat which was continually given off in this manner in the foregoing experiments? Was it furnished by the small particles of metal, detached from the larger solid masses, on their being rubbed together? This, as we have already seen, could not possibly have been the case: *first,* because this water was continually *receiving Heat* from the machinery, and could not at the same time be *giving to,* and *receiving Heat from,* the same body; and, *secondly,* because there was no chemical decomposition of any part of this water. Had any such decomposition taken place (which, indeed, could not reasonably have been expected), one of its component elastic fluids (most probably inflammable air) must at the same time have been set at liberty, and, in making its escape into the atmosphere, would have been detected; but though I frequently examined the water to see if any air-bubbles rose up through it, and had even made preparations for catching them, in order to examine them, if any should appear, I could perceive none; nor was there any sign of decomposition of any kind whatever, or other chemical process, going on in the water. . . .

Was it furnished by the air? This could not have been the case; for, in three of the experiments, the machinery being kept immersed in water, the access of the air of the atmosphere was completely prevented.

Was it furnished by the water which surrounded the machinery? That this could not have been the case is evident. . . .

And, in reasoning on this subject, we must not forget to consider that most remarkable circumstance, that the source of the heat generated by friction, in these experiments, appeared evidently to be *inexhaustible.*

It is hardly necessary to add, that anything which any *insulated body,* or system of bodies, can continue to furnish *without limitation,* cannot possibly be *a material substance;* and it appears to me to be extremely difficult, if not quite impossible, to form any distinct idea of anything capable of being excited and communicated in the manner the heat was excited and communicated in these experiments, except it be *motion.*

Benjamin Thompson, Count Rumford, was born at Woburn, Massachusetts, March 26, 1753, and died at Auteuil, near Paris, August 21, 1814. In 1776 he took up his residence in England, and held several positions in the department of state. In 1783 he started for Austria to join the army which was fighting the Turks, but stopped in Strassburg and became involved in the political affairs of Bavaria. He lived in Munich for 11 years, later returning to England. In 1804 he removed to Paris, where he married as his second wife the widow of the chemist Lavoisier. It was during his residence in Bavaria that he was made a Count of the Holy Roman Empire, taking his title from Rumford, now Concord, Mass.

Count Rumford was interested in experimental science from boyhood throughout his life. During his first residence in England he studied firearms and explosives. In Munich he carried out striking sociological experiments to better the lot of large beggar population. Back in London, he invented an improved stove and studied the nuisance of smoky chimneys. In 1799 he and Sir Joseph Banks established the Royal Institution, selecting Sir Humphry Davy as lecturer.